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Publication Brief for Resource Managers

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Evaluating the Potential for Watershed Restoration to Reduce Nutrient Loading to Upper Klamath Lake, Oregon

Declining populations of the endangered Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostris*) have been attributed to poor water quality in Upper Klamath Lake (U.S. Fish and Wildlife Service, 1998). The lake is classified as hypereutrophic, and the resulting water quality associated with this condition is considered a probable cause for the decline of these native fish species and a major limiting factor in their recovery.

The Oregon Department of Environmental Quality now requires that phosphorus levels in Upper Klamath Lake be reduced by 18 percent over the next 10 years. The management goal for phosphorous reductions is to reverse the decline of the lake's two endangered lake suckers. As the agency responsible for the recovery of threatened and endangered species, the U.S. Fish and Wildlife Service (FWS) is in the process of identifying ways to meet this criterion for phosphorous levels in the watershed. Watershed nonpoint source control, over the past 30 years, has been principally accomplished through a variety of best management practices (BMPs). FWS officials asked the U.S. Geological Survey (USGS), Fort Collins Science Center (FORT), to conduct a comprehensive literature review on best practices for reducing phosphorous levels in rivers and streams. The objective was to discover whether management best practices applied in the region might be appropriate for consideration in the Klamath Basin, and supply this information to FWS managers.

The primary land use in the Klamath basin is cattle grazing. Runoff from grazing areas is a major source of phosphorous loading in Upper Klamath Lake as well as in the river and its upstream tributaries. FORT hydrologists focused their literature review on BMPs widely cited in reducing nutrient loading in North America and, where



Upper Klamath Lake, Oregon. USGS photo.

possible, in the Pacific Northwest region. In particular, they emphasized BMP literature on cattle grazing and management techniques aimed at reducing phosphorous in surface runoff. In this report, best management practices are defined as measures, sometimes structural, that are determined to be the most effective, practical means of preventing or reducing pollution inputs from nonpoint sources to water bodies (Don Chapman Associates, 1989).

In the absence of historical landscape features that once regulated sucker populations and water quality in Upper Klamath Lake, implementation of selected BMPs in the watershed may assist resource managers in making incremental progress toward sucker recovery objectives and meeting the 18 percent phosphorous reduction criterion. A variety of habitat restoration and water quality

objectives are considered critical to the recovery of the endangered suckers. The report addresses which BMPs might be most appropriate or effective in achieving phosphorus-loading reductions for the watershed. Although BMPs have already been implemented in the watershed (for example, management of upstream wetland and riparian habitats to control phosphorus loading to the lake), their effectiveness in reducing phosphorus loading and their costs for installation and maintenance are not well known. To date, there has been no quantitative evaluation of the effectiveness of watershed BMPs and restoration projects in providing realized benefits to water quality.

This report discusses both causes of nutrient loading and a wide variety of BMPs used to treat or reduce causal factors, including restored and constructed wetlands, irrigation and cattle management, riparian buffer strips, stream corridor fencing, and various grazing practices. These BMPs seem to have potential for reducing phosphorus loading that can result from cattle grazing. Although no single BMP is likely to be the most effective in all locations or situations, water quality improvement in Upper Klamath Lake could result in increased abundance and survival of sucker populations.

Full Report:

McCormick, Paul, and Campbell, Sharon G., 2007, *Evaluating the potential for watershed restoration to reduce nutrient loading to Upper Klamath Lake: U.S. Geological Survey Open-File Report 2007-1168, 31 p.* Available online at http://www.fort.usgs.gov/Products/Publications/pub_abstract.asp?PubID=22013.

References:

- Campbell, S.G., ed., 1993, Environmental research in the Klamath Basin, Oregon—1991 annual report: U.S. Bureau of Reclamation Technical Report R-93-13, 276 p.
- Don Chapman Associates, 1989, Monitoring BMPs and non-point source pollution—Advanced riparian course: March 6–10, 1989, Boise, Idaho, 300+ p.
- U.S. Fish and Wildlife Service, 1998, Klamath Basin ecosystem restoration strategy: Klamath Falls, Oregon, 3 p.

Management Implications

Significant costs are associated with BMP implementation and maintenance, in terms of materials and labor as well as the location of and level of participation in a watershed program for Upper Klamath Lake. If willing landowners are not identified—in particular, those with property located along an important drainage channel or downstream of other participating landowners—then the benefits produced by those upstream or off-channel may be significantly diminished. In addition, pre- and post-implementation water quality monitoring is critical to identify specific BMPs that yield the best return for investment in the watershed.

No single BMP may be universally applicable to land use in the UKL watershed. Stream corridor fencing seems to be a likely method for reducing total phosphorous loading, but in the Sprague River Valley, where there is no headwater hydraulic control, winter and spring flooding can quickly remove large sections of fencing. Keeping fencing intact in this watershed could require significant and highly variable annual labor and materials costs that are completely dependent on the meteorological conditions in a given year.

Constructed and restored wetlands did appear to have a significant potential for reducing nutrient loading to the lake. However, wetlands can be sources of dissolved phosphorous that is readily available for algal growth; and trading off total phosphorous loading reductions for dissolved phosphorous loading increases may exacerbate lake eutrophication issues rather than alleviate them. Size, location, and maintenance of wetlands have to be factored into this BMP implementation, and there are certainly instances where a wetland treatment may be both appropriate and highly effective.

Water quality monitoring information is the greatest need for BMP implementation effectiveness. Less than 5 percent of BMPs have scientifically rigorous monitoring both prior to and following implementation to determine their ability to reduce nutrient loading. The expense of sample collection and analyses; the required expertise to interpret data results; and in cases, the reluctance of private landowners to allow access to their property for sample collection are potential impediments to quantifying BMP effectiveness. Historical data such as reported in Campbell and others (1993) may be valuable, along with data available from other USGS, Tribal, State, Federal agency, or consultant sources to partially fill this gap in water quality information.